Imperial College London

K. Long,
20 September, 2013

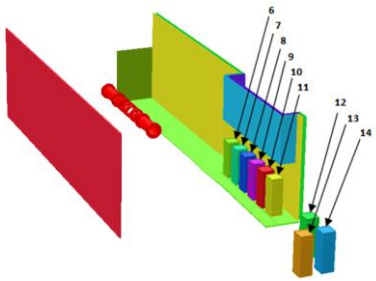
Overview of strategy:

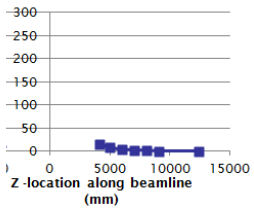
Mitigation of stray magnetic field

History

V. Bayliss; CM33, Jun12:

Step IV: Compressors





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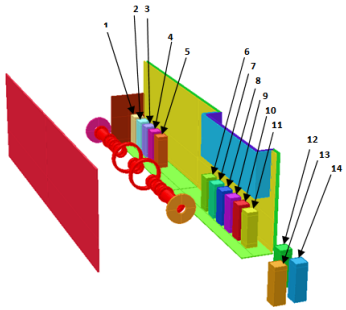
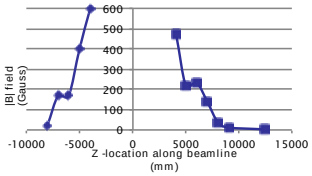
Step VI: Compressors





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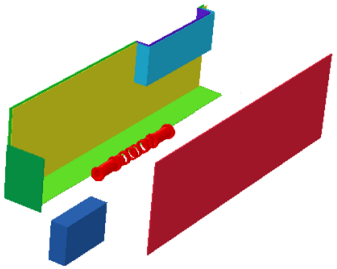
Step IV: Magnet Control Racks



Simplified solution shows it is possible to shield in 5mm US1010 iron and 5mm mu-metal if Aluminium racks are used.

In reality, we will need to provide protected access (labyrinth or air-lock style) to allow access during magnet operation.

This implies serious modifications to the positions of magnet control racks, their services and the entrance to the trench.

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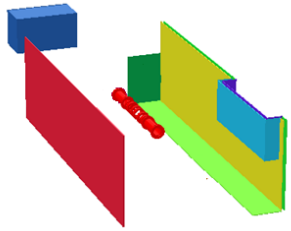
Step IV: Electrical Racks on North Mezzanine



- 4 racks located on the north mezzanine
- 5mm US1010 iron and 5mm mu-metal if Aluminium racks are used.
- Estimated weight 3-5 tonnes – requires major modifications to the north mezzanine

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Strategy adopted:

- Requirement:
  - Develop mitigation strategy that:
    - Reduces stray field to acceptable level for all sensitive equipment;
    - Reduces remaining risk that stray field will impair operation of equipment;
    - Preserves as far as possible the Step IV schedule
      - Data taking after ISIS long shutdown; Mar15
- Parallel approach adopted:
  - Baseline:
    - Remove items (e.g. compressors and racks) from regions of high magnetic field where possible;
    - Develop local shielding options for items (e.g. tracker cryostats) that can not be moved to remote locations;
  - Mitigation of risk that shielding of one or more items to acceptable level is not possible:
    - Develop partial return yoke

  Parallelism a strength:

  UK personnel developed baseline;

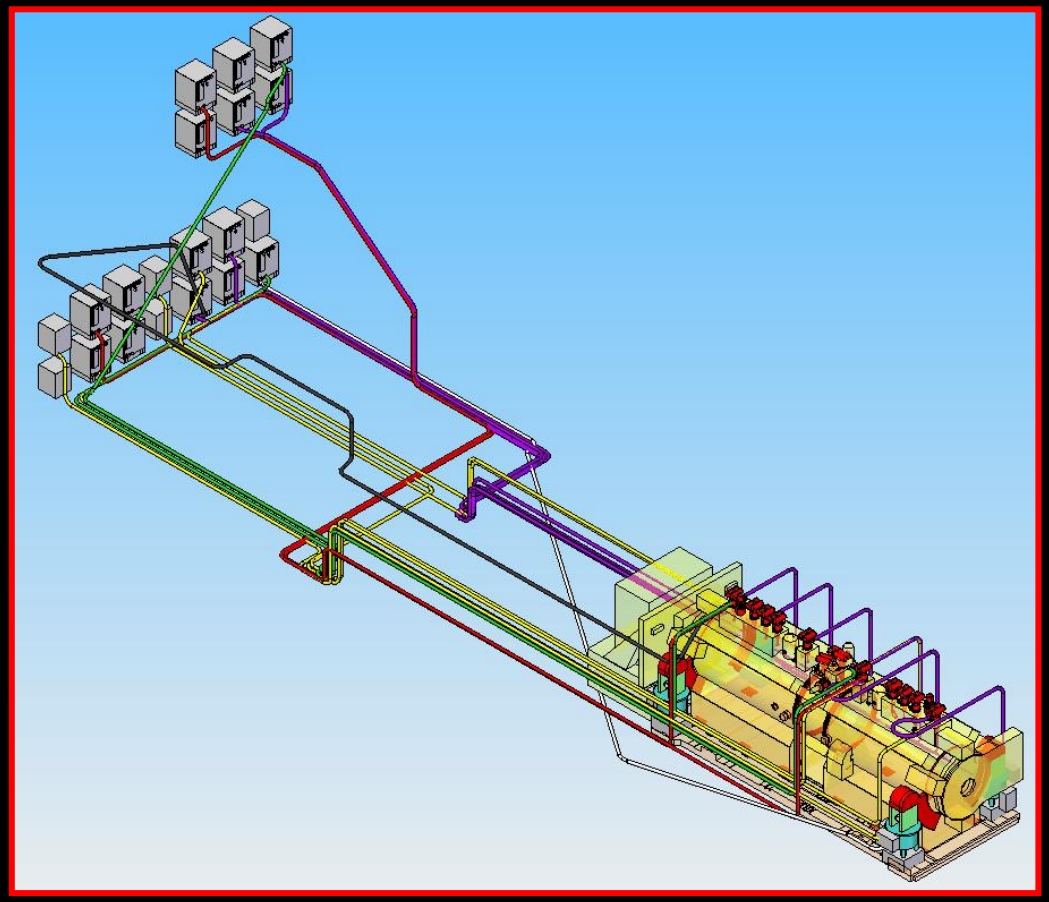
  US personnel developed partial return yoke
- At CM33 it was not clear that a partial return yoke could be developed that satisfied:
  - The mitigation requirements;
  - The constraints of the MICE Hall;
  - Preserved the schedule at least to Step IV
- The study of the baseline and partial return yoke is now sufficiently mature to allow the original strategy to be reviewed

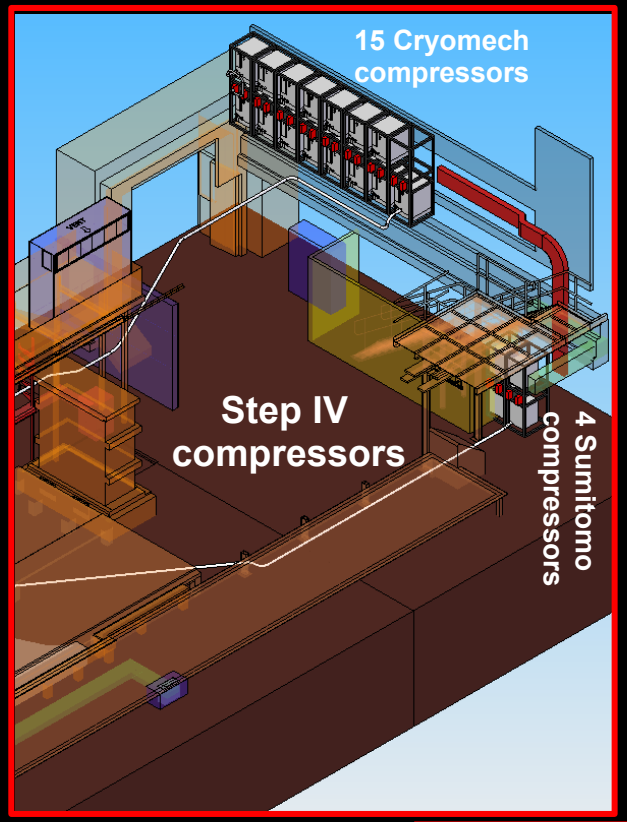
Mitigation of stray magnetic field

Steps taken:

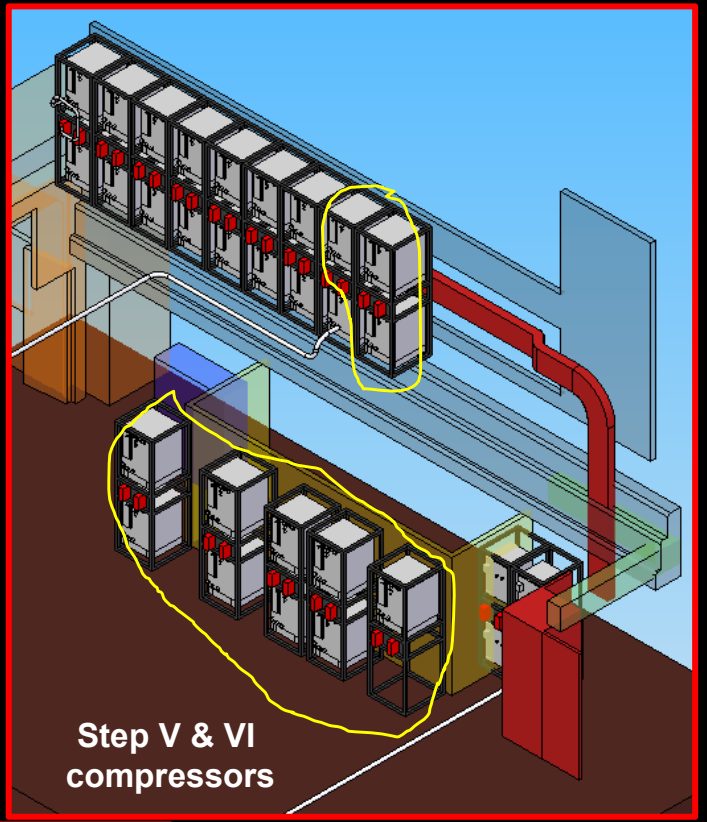
Compressor relocation:

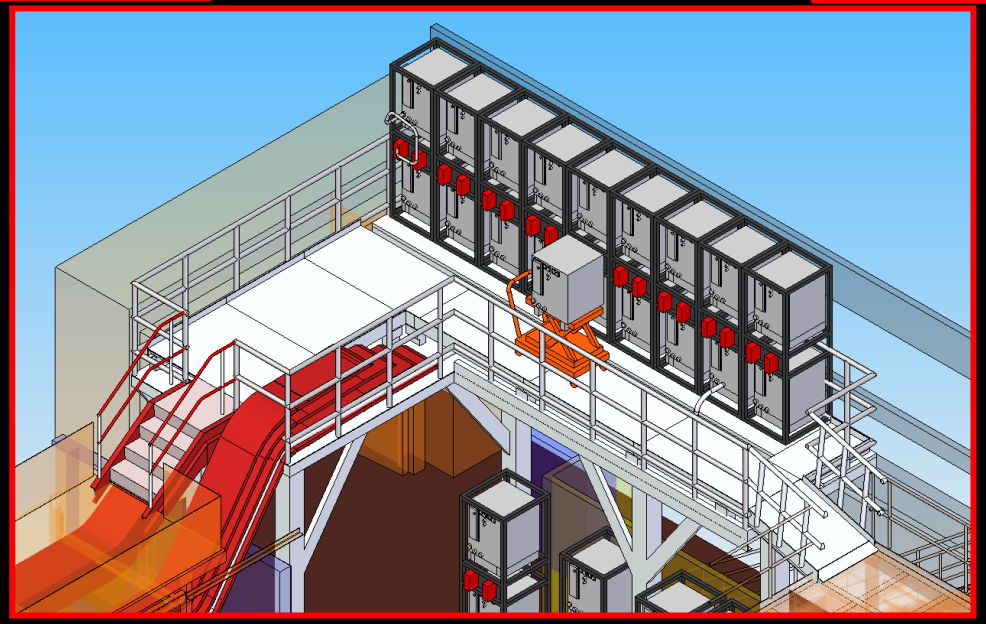
- Compressors located to meet <= 30m high-pressure hose lengths
- Build necessary structure to support compressors & services
- Additional requirements
  - Personnel access
  - Compressor access (for installation & swap)
  - Equipment delivery & assembly space (especially MICE devices)





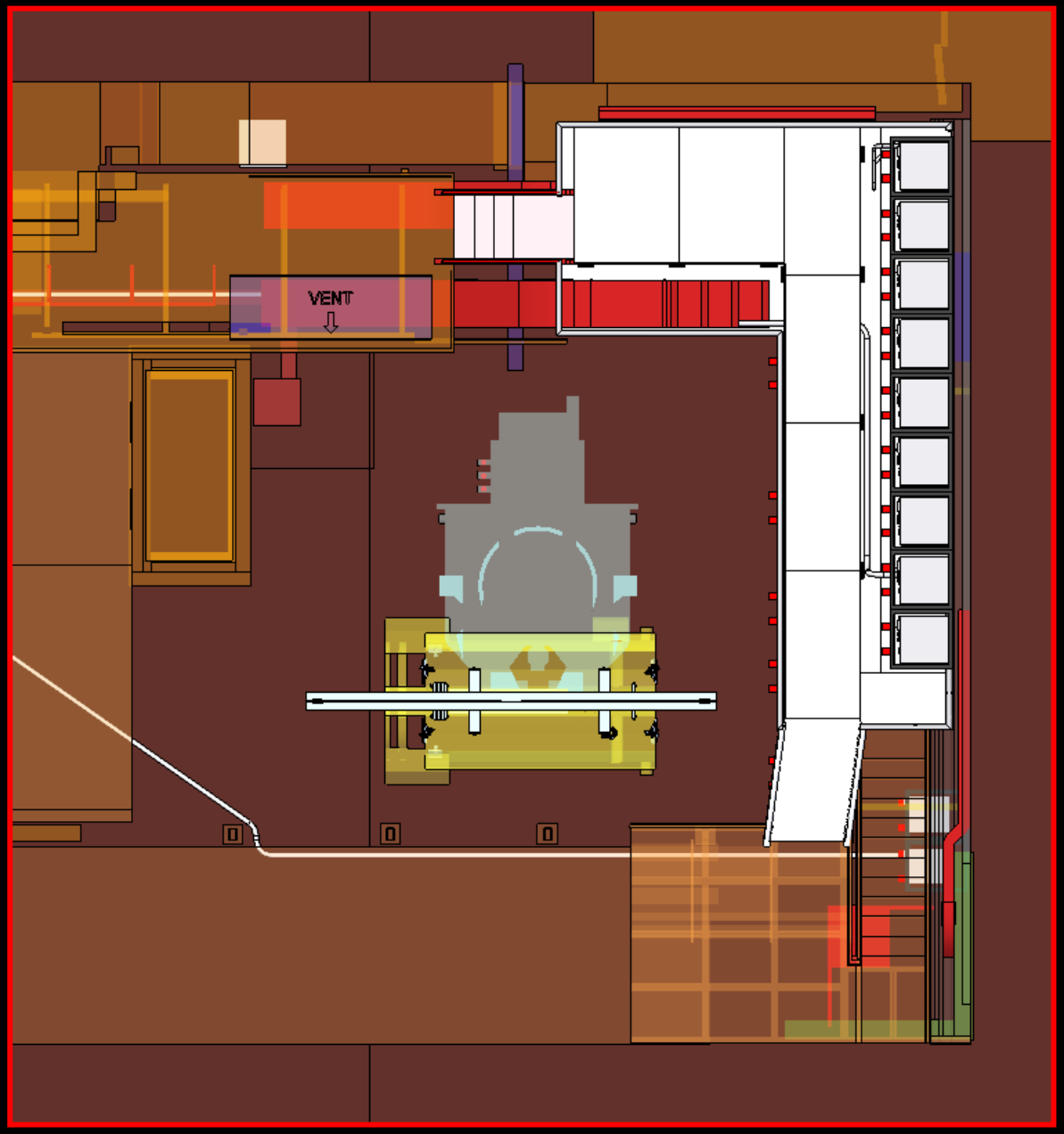
- Document in preparation for transmission to Technical Board
- Strong pressure now to move from design to execution





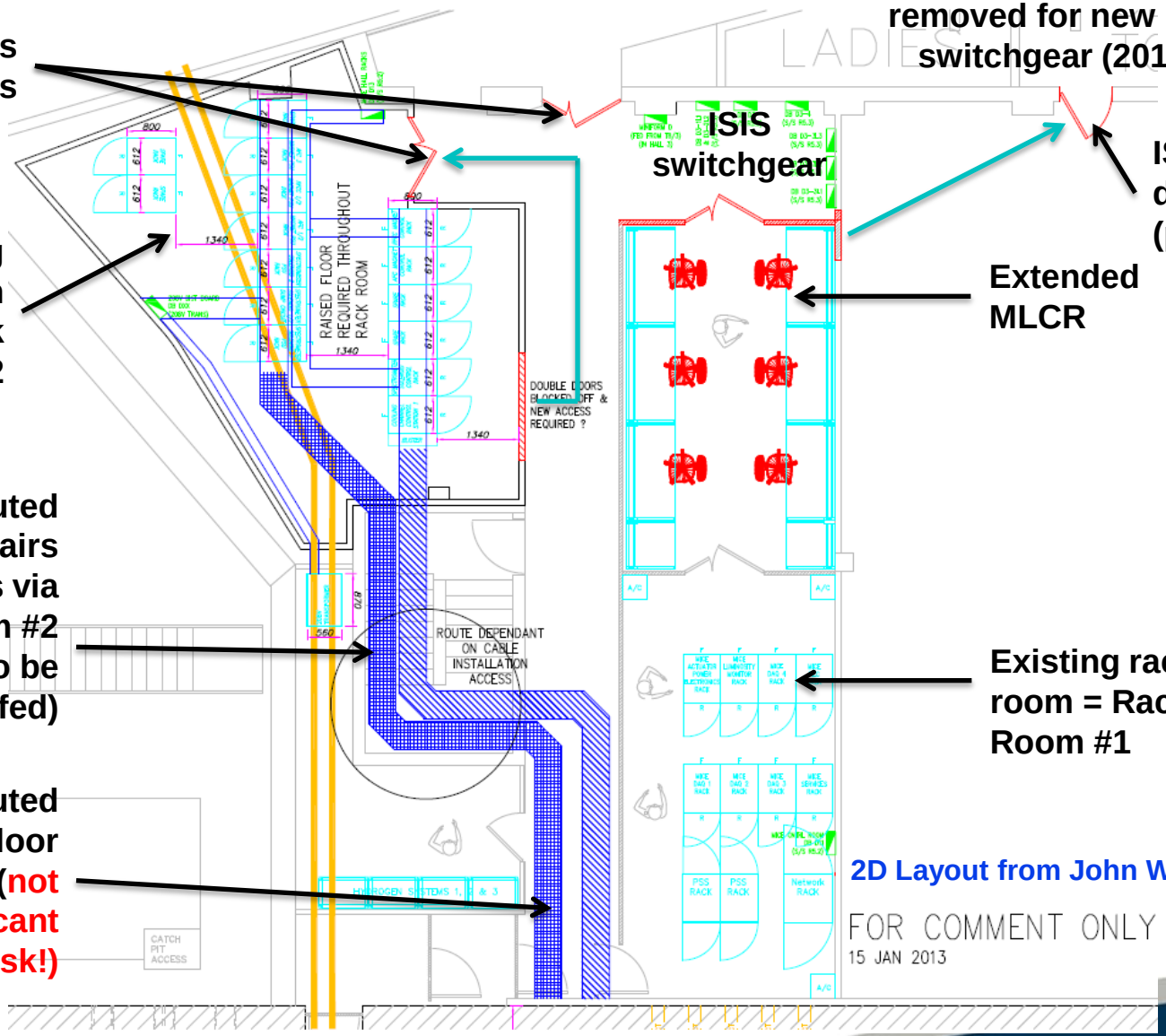
J. Tarrant

Equipment delivery and assembly area:



J. Tarrant

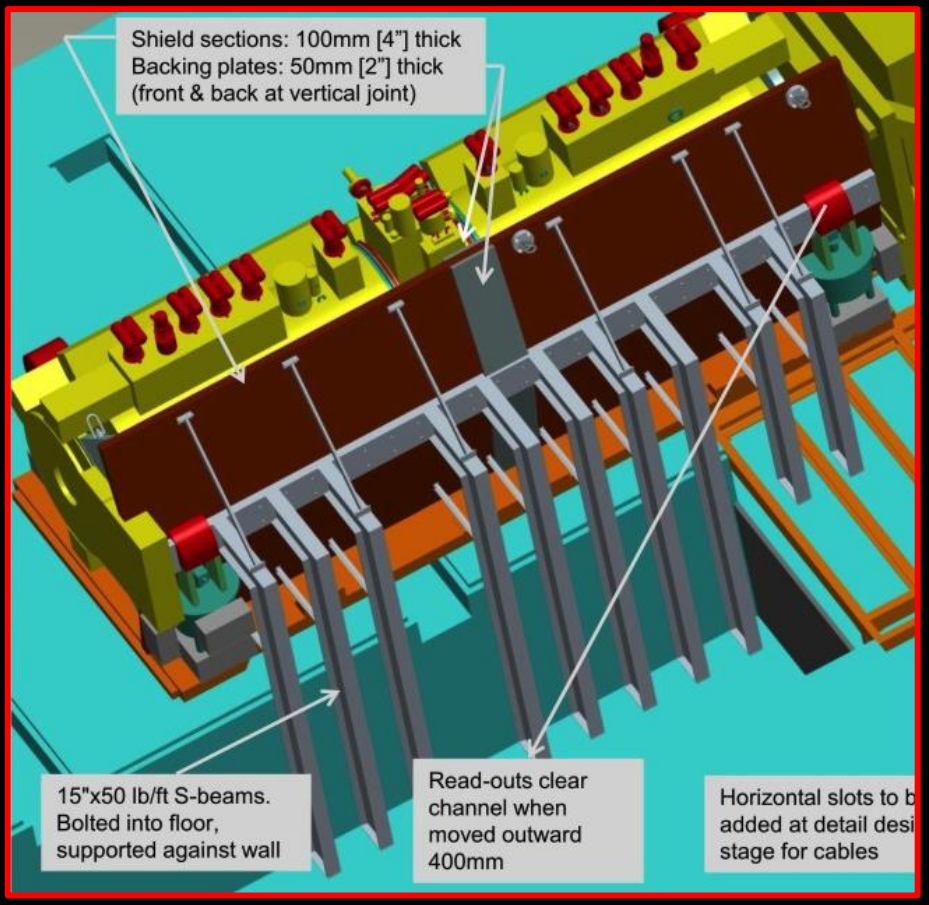
MLCR & Rack Room #2

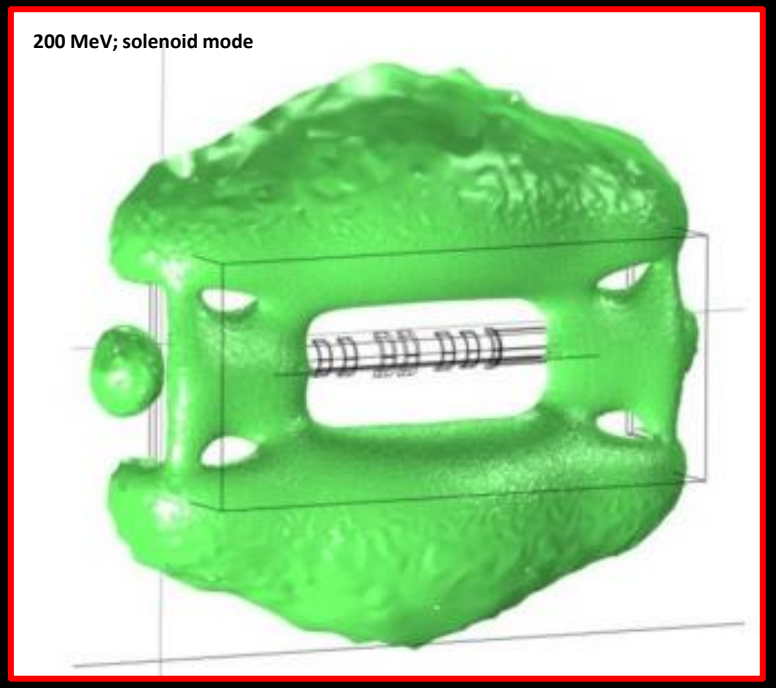


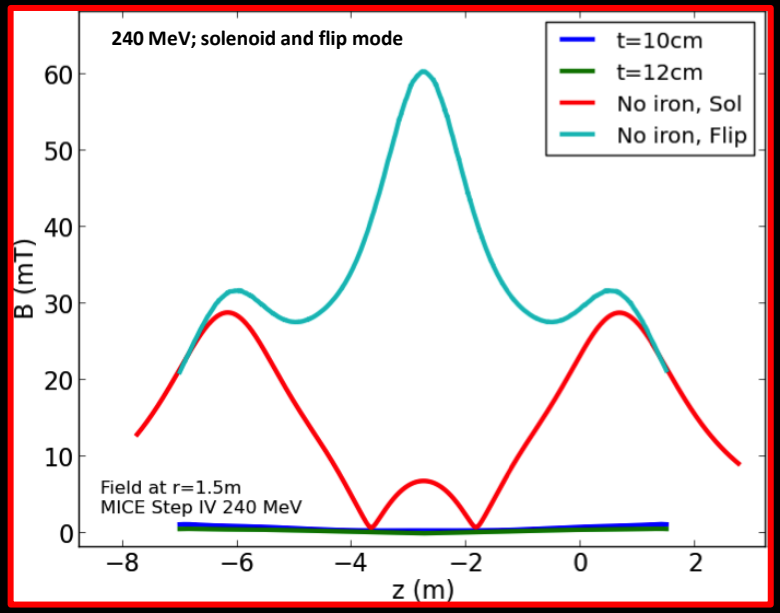
Mitigation of stray magnetic field

Partial return yoke

PRY concept and performance:







- **Partial return yoke:**
  - **Contains field in the vicinity of the MICE magnetic channel:**
    - **5 G line contained within the MICE Hall**
      - **No issues in South Side Buildings**
  - **Require to perform full simulation of yoke in the MICE Hall Model**
    - **Expect acceptable fields at (e.g.):**
      - **RF amplifiers;**
      - **Tracker electronics**
    - **Require to check (e.g.):**
      - **Field on roof and at LH2 gas panel**

Mitigation of stray magnetic field

Conclusions and recommendations

Magnetic Shielding Group conclusions:

- **Baseline:**
  - Results indicate that can shield at Step IV
    - Technical risk:
      - One or more critical items will not be shielded such that performs to specification
  - PRY required for Step V/VI because coupling coil likely to yield unacceptably large fields at the position of the:
    - RF amplifiers (electron tubes);
    - Electricity substation;
    - South Side Buildings (including the ISIS control rooms)

- **PRY:**
  - Results indicate that integration in the Hall at Step IV can be accommodated with modest modifications to existing infrastructure;
    - Significant modifications are required for Steps V/VI
      - Mitigation:
        - » Time to plan and execute alongside substantial engineering projects
  - Initial analysis of schedule indicates delay to implementation of Step IV is modest
  - While PRY will extend time required to exchange absorbers;
    - Initial analysis indicates that the exchange is managable

Mag. Mitigation Group's recommendations:

- Initial analysis of implementation schedule:

	Finish Date	Delayed finish due to Risk
StepIV base line	2/1/15	29/9/15
SS before PRY	30/1/15	27/10/15

- Assuming either:
  - Full resource leveling does not change projected end dates substantially *and/or*
  - Additional resources can be raised to allow the projected end-date to be preserved

- Mitigation Group's recommendations:
  - Install the partial return yoke at Step IV
  - Seek implementation such that a "Step IV fit-up" and a "field-off shakedown" run can be performed before the long shutdown